DEVELOPMENT OF CAREION ANODE FOR RECHARGEABLE LITHIUM CELLS

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ABSTRACT

Jet Propulsion Laboratory (JPL) is involved in the development of carbon anode for long life rechargeable lithium cells for two years. The results obtained so far indicate that the performance of carbon electrode is dependent critically on the (1) nature of the carbon material (2) electrode fabrication process (3) electrode formation procedures and (4) type of electrolyte and its composition. Several graphitic and coke based carbonaceous materials were evaluated as candidate anode materials. Graphitic carbons were found to exhibit higher reversible lithium capacity compared to the coke based materials. Heat treatment of both graphite and coke based materials was found to result in higher lithium capacity. Ethylene Propylene Diene Monomer (EPDM) was selected as a suitable binder material for the fabrication of electrodes. The results of the electrode fabrication studies indicated that the amount of binder required for a carbon material is dependent on its surface area. Excessive amount of binder were found to affect the reversible lithium capacity and rate capability of the electrode. JPL has developed a two step procedure for the formation of Li_xC electrode. This process involves the intercalation of lithium into carbon in two different steps. The electrode prepared by this method exhibited higher reversible Li capacity compared to the single step process reported in the literature. Lithium capacity and reversibility of the carbon electrodes were also found to be significantly dependent on the nature of the electrolyte and its composition. Seventeen different electrolytes were evaluated as candidate electrolytes for l-i-ion cells. Mixed solvent electrolytes containing ethers and carbonates were investigated in this study. Experimental results obtained so far indicate that increase of ethylene carbonate (EC) was found to improve the rate capability of the cells. However, the increase in EC content was also found to increase the amount of electrolyte decomposition. The electrolytes containing EC and diethyl carbonate (DEC) with lithium hexafluorophosphate ($LiPF_6$) salt were found to be promising for Li ion cells. Experimental Li-ion cells were fabricated and the testing of the cells is in progress. The results of these studies are described in this paper.